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ABSTRACT

Findings of a study that examined the collaborative problem-solving processes used by superintendents are presented in this paper. Based on information processing theory, the study utilizes a model composed of the following components: interpretation; goals; principles and values; constraints; solution processes; and mood. Data were derived from stimulated-recall interviews conducted with seven superintendents with reputations of effectiveness. Participants were asked about the group problem-solving processes involved in a previously audiotaped meeting with their senior administrative colleagues. Findings indicate that the superintendents placed problems in a broader context, procured majority participation, were reflective, fostered organizational learning, and sought the best group solution. (66 references) (LMI)

Superintendents' Group Problem-Solving Processes

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Abstract

The problem-solving processes of seven reputationally-effective superintendents were studied during regular meetings with senior administrative staff. An information-processing orientation guided the coding of verbal protocol data collected through the use of a stimulated recall technique. Results describe superintendents' processes for interpreting problems and setting goals for their solution. Also described are their processes for dealing with constraints, the nature of solution processes and the role of values and mood in superintendents' problem solving.

Superintendents' Group Problem-Solving Processes

Peter Vail (1989) claims that today's executives "...live in a world of permanent white water" (p. 2) - a world in which few assumptions are beyond scrutiny and the environment sometimes appears chaotic. In such a contingent world, well-rehearsed, routine, managerial behaviors provide the solution to a rapidly decreasing proportion of the potential problems lurking in the choppy waters executives navigate daily. It is the prevalence of wicked or ill-structured problems, just below the surface of the water, that explains why even a light breeze often results in whitecaps. And, sometimes, apparently benign problems turn out to be deceptively wicked. Such a perspective explains the need for executives to have a repertoire of general problem-solving skills along with a considerable store of knowledge about their specific businesses, to help cope with unpredictable and new problems.

The study of executives' problem-solving processes has been underway for some time in organizational settings outside of education (see, for example, Srivastva, 1983; Schwenk, 1988; Argyris, 1982). But little systematic attention has been devoted to the thinking and problem solving of educators in formal leadership positions. The study described in this paper was one in a series aimed at redressing this neglect. Prior studies in the series have focused on school principals (e.g., Leithwood & Stager, 1989; Leithwood & Steinbach, 1991b) as well as superintendents (e.g., Leithwood & Steinbach, 1991a).

Among the results of our prior studies is evidence that as educational leaders become more "expert", more experienced in their roles and move to more senior positions, they rely more extensively on solving their problems in collaboration with groups of colleagues, rather than by themselves (Leithwood & Steinbach, 1990). Indeed, some leaders are able to use the context of group problem solving not only for developing productive solutions to their problems and enhancing the subsequent implementation of those solutions, but also for fostering powerful forms of staff

development (Leithwood & Steinbach, 1991b). To explore these tentative findings further, the study described here asked: What purposes are being served by superintendents when they engage in collaborative problem solving with their senior colleagues? How do superintendents accomplish these purposes?

Framework

Our previous studies of executive problem solving have been guided by information-processing theory. Among other products, this research generated the multi-component model of executive problem solving which served as a framework for data collection in the present study. The components of that model are: Interpretation, Goals, Principles and Values, Constraints, Solution Processes, and Mood. This section briefly outlines several key features of an information-processing orientation to problem solving; it also identifies additional selected features of such an orientation in the context of describing the main elements of our problem solving model.

An Information-Processing Orientation to Problem Solving

Information processing orientations to problem solving are embedded in a broader theory of how the mind works. This theory consists of hypothetical structures and relationships explaining why people attend to some aspects of the information available to them in their environments, how their knowledge is stored, retrieved and further developed and how it is used in solving problems (see, for example, Gagné, 1985; Newell, Rosenblum & Laird, 1990; Rumelhart, 1990). From this perspective, problems are defined as circumstances in which a gap is perceived between a current state and a more desirable state (Gagné, 1985; Hayes, 1981). When both states are clearly known and the procedures to follow (or operators) to get from one to the other are also known, a problem is considered routine or well structured. Lack of knowledge about any of these three elements in the "problem space" (Newell & Simon, 1972) makes a problem less well structured.

Hence, the objective complexity of the problem and the relevant knowledge possessed by the solver combine to determine the degree of novelty or structure of a problem.

Information processing orientations to problem solving devote considerable attention to the concept of "expertise" and the patterns of thought which distinguish between those who possess high levels of expertise and others. Expertise is associated with both effective and efficient problem solving within a particular domain of activity (like leading a school system). Research across many domains suggests, for example, that experts: excel mainly in their own domains; perceive large meaningful patterns in their domains; solve problems quickly with few errors; and have superior short and long term memories for information in their domains. Experts also represent problems at deeper, more principled levels than novices; they spend more time than novices interpreting (as distinct from solving) problems. And experts are able to monitor their own thinking much better than are novices (Glaser & Chi, 1988). The amount of domain-specific knowledge possessed by experts and the way it is organized is offered as the primary explanation for these attributes (Van Lehn, 1990; Nickerson, 1988-1989). General problem-solving processes or heuristics, in the absence of such knowledge, are not considered powerful tools for problem solving. Rather, such processes help people to gain access to useful knowledge and beliefs that they otherwise may have overlooked (Bransford, in press).

Well-structured problems, usually those repeatedly encountered by expert executives, are solved with little conscious thought. The problem is recognized as an instance of a category of problems about which the executive already knows a great deal. As Simon (see this journal issue) argues:

> "... any expert can recognize the symptoms, the clues, to the bulk of the situations that are encountered in his or her everyday experience. The day would simply not be long enough to accomplish anything if cues didn't do a large part of the work for the expert."

Such recognition permits the executive access to all of the knowledge he or she has stored in long term memory about how to solve that category of problem. But because no comparable store of knowledge is available for ill-structured problems, the executive needs to respond in a more deliberate, thoughtful manner. As executives face a greater proportion of ill-structured problems, better understanding of these deliberate, thoughtful processes becomes increasingly important (Day & Lord, 1992; Schwenk, 1988) as does enhancing the expertise with which they are carried out. Furthermore, the degree of discretion and the cognitive demands placed on executives appear to increase the higher their position in the organization (Mumford & Connelly, 1991; Hunter, Schmidt & Judiesch, 1990), in part because of the extended time horizons over which solutions to their problems must be planned and the accompanying abstractness of the thinking that necessitates (Jaques, 1986). This makes learning more about the problem solving of senior executives, like superintendents, especially worthwhile.

Components of a Problem-Solving Model

There are two general categories of processes involved in problem solving; understanding and solving (Hayes, 1981; Van Lehn, 1990; Voss & Post, 1988). Understanding processes serve the purpose of generating an executive's internal representation of the problem - what she or he believes the problem to be. Solving processes aim to reduce the gap between current and desired states - how the executive will transform the current state into the more desirable goal state. Understanding and solving often interact during the course of problem solving as feedback from initial steps taken toward a solution builds a richer understanding of the problem. Both sets of processes require searching the contents of memory for existing knowledge helpful in either understanding or solving the problem.

The multi-component model of executive problem solving which served as a framework for collecting data in this study includes two components which address primarily understanding:

Interpretation and Goal Setting. Two components are concerned primarily with solving: Constraints and Solution Processes. Components of the model labelled Principles/Values and Mood seem equally relevant to both understanding and solving. This section provides an explanation of the cognitive processes encompassed by each component. In addition, characteristics of expertise in relation to each component are described, based on our own prior research with educational administrators. Those characteristics of expertise selected as a focus of attention in the present study are designated with an asterisk (*).

Processes designed primarily for understanding problems: Interpretation and Goals

Interpretation. Executives are bombarded with much more information from their environments than they can possibly think about (Simon, this issue). Furthermore, because this information frequently presents itself as an untidy "mess", rather than a clearly labelled set of possibilities, there may be a host of potential problem formulations. Problem interpretation is an instance of giving meaning to and evaluating such information (Kelsey, in press). Meaning is created as newly encountered information is compared with those "schema" - organized contents of long term memory - which the executive thinks might be relevant (Van Lehn, 1990). Such schema have two parts: one for describing the problem and the other for describing the solution. Non-routine or ill-structured problems may be difficult to understand for several reasons. For example, more than one schema could apply to the problem, giving rise to the need for a sometimes "trial and error" search for the most workable schema; two or more schema may have to be combined in order to adequately cover the whole problem.

The complex process of understanding ill-structured problems is aided by the use of problem categories which are learned from experience. As Chi et al (1981) explain, "... categorization of a problem as a type cue[s] associated information in [one's] knowledge base ..." (p. 122). The search for and combining of schema can be limited to stored schema considered relevant to the problem category. A series of studies by Cowan (1986, 1988, 1990,

1991) suggests, for example, that executives normally distinguish between strategic and operational problems, and between technical and human problems. Different processes seem to be used to solve each of these categories.

Problem interpretation involves not only making sense of information by comparing it to existing schema. It also requires evaluation: the perception of a discrepancy between the executive's understanding of current reality and a more desirable reality. As Cowan (1990) points out:

> "This dynamic highlights the importance of an evoked problem concept in directing attention ..., in cuing related knowledge to assist interpretation ..., and in constraining search and solution activity ... Once executives categorize a situation as a particular problem, causes are related to the initial categorization ..., as are reformulation, ... [and] the search for solutions ..." (p. 366-367)

Our evidence from educational administrators suggests that, as compared with non-experts, experts:

- *develop a relatively clearer understanding of the problem before attempting to solve it;*
- *devote more time and effort to the initial formulation of ill-structured problems;*
- *are more inclined to view the immediate problem in its relationship to the broader mission and problems of the organization.**

Goals. Understanding an ill-structured problem sufficiently well to solve it usually requires decomposing it into pieces that are more manageable (Newell, 1975; Hayes, 1980). This begins to transform the often abstract, general interpretation of an ill-structured problem into a set of more precise goals which can serve as targets for problem solving activity (Voss & Post, 1988). Given these more precise goals, the executive is better able to compare the current state with the goal at each stage of the process, as is normally possible with well-structured problems

(Greeno, 1978). Similar to what is accomplished through problem classification, such goals also provide relatively direct access to stored knowledge relevant to solving the problem without the need for more elaborate, time-consuming and possibly inaccurate search processes necessitated by vague goals (Greeno, 1980).

Our prior research suggests that expert as compared with non-expert educational administrators:

- *adopt a broader range of goals for problem solving;**
- *when solving problems in groups, experts have less personal stake in any preconceived solution. Rather, their aim is to arrive at the best solution the group can produce;**
- *more often establish staff development as one explicit goal, among others, for solving problems in groups.**

Processes designed primarily for solving problems: Constraints and Solution Processes

Constraints. The distinction between well-structured and ill-structured problems is a matter of degree. How much an executive already knows that is relevant to solving a problem is one factor in determining the extent to which a problem is well-structured. Another equally important factor is the number of constraints that must be addressed in solving the problem (Reitman, 1965; Voss & Post, 1988). Once goals are set, much of problem solving involves recognizing and dealing with constraints to accomplishing those goals. Often constraints arise, or are encountered, only in the midst of solving a problem. These may be obstacles (absence of something required in order to continue) or errors (an action taken had an inappropriate result). Constraints may also be distractions (Shank & Abelson, 1977); for example, some other problem requiring immediate action comes to the executive's attention. And, in the case of multi-step problem-solving processes, the actions taken at a prior step become constraints on possible actions at later steps. For example, in order to cope with the problem of a deficit budget, a superintendent may request all central office unit heads to cut back five percent on their projected spending for the current year. One unit head refuses to

do so - a constraint facing the superintendent in solving the deficit problem. Threatening to fire the unit head unless he or she complies makes "voluntary restraint" among units an unlikely strategy for coping with the deficit problem in subsequent years.

As compared with non-experts, our prior research suggests that expert educational administrators:

- *more adequately anticipate many of the constraints likely to arise during problem solving;*
- *show a greater tendency to plan, in advance, for how to address anticipated constraints;*
- *respond more adaptively and flexibly to constraints which arise unexpectedly;**
- *do not view constraints as major impediments to problem solving.*

Solution Processes. The overt or covert steps or actions taken in order to achieve goals for problem solving is our meaning of "solution processes". Such actions or steps result from a deliberate search through memory for relevant procedural schema. These are structures in the mind about how to perform certain actions, a set of instructions for action - for example, how to develop a budget, how to resolve a conflict with a trustee, how to ensure one's position is made clear in a two minute radio interview.

Procedural schema take several forms, each more or less appropriate to different problem conditions. One set of conditions occurs in the face of problems or sub-problems that are relatively well-structured. Under this set of conditions, procedural schema of most use take the form of "scripts" (Shank & Abelson, 1977). These are well-rehearsed sequences of actions leading to a desired goal. They may be quite elaborate, including long causal chains of actions and an anticipated role for many other people. But because they are so well-rehearsed, they are also fairly rigid. Unanticipated deviations from the script (e.g., errors, distractions) require novel responses to be grafted

onto the script. Such responses may be thought of as micro-scripts, a type of script that seems relevant, also, when solution processes are developed more spontaneously, during action. Reflection-in-action, to use Schön's (1983) term, involves intuitive and rapid search processes through memory for guides to short sequences of action or micro-scripts.

A second set of conditions occurs when the executive is faced with more ill-structured problems or sub-problems. Under such conditions, searches through memory are unlikely to locate a script that will solve the problem. The more likely outcome of such a search will be a "plan" (Shank & Abelson, 1977; Suchman, 1987). A plan is:

> "... the repository of general information that will connect events that cannot be connected by use of an available script ..." (Shank & Abelson, 1977, p. 70)

It describes the choices available to the executive as she attempts to accomplish a goal. A plan may include a number of different scripts connected in novel ways (Van Lehn, 1990).

For a plan to be developed by an executive as a guide to solving an ill-structured problem, the executive must still possess considerable, problem-relevant knowledge, although that knowledge initially is not organized as efficiently as a script for solving the problem. Under a third set of problem-solving conditions, executives may not possess even this initially inefficiently organized knowledge. When problem-relevant procedural knowledge is not available, executives must rely on a third type of structure called general "heuristics". These include such content-free procedures as brainstorming, means-end analysis, use of analogies and metaphors, collecting more information about possible steps and trial and error (Rubinstein, 1975; Brightman, 1988; Hayes, 1981; Newell & Simon, 1972).

Our previous studies of school principals solving problems in groups (Leithwood & Steinbach, 1991b; Leithwood & Steinbach, in press) found that, as compared with non-experts, experts:

- *had well-developed plans for collaborative problem solving (meeting);**
- *provided a clear, detailed introduction to the problem and its background to collaborators;**
- *outlined clearly the process for problem solving (e.g., how the meeting will be conducted);**
- *carefully checked collaborators' interpretations of the problem and their own assumptions;**
- *without intimidating or restraining others, clearly indicated their own view of the problem and its relationship with larger problems;**
- *remained open to new information and changed views, if warranted;**
- *assisted collaborative problem solving by synthesizing, summarizing, and clarifying as needed;**
- *had strategies for balancing the need to keep the group on track (focused) and allowing discussion;**
- *ensured that follow-up was planned.**
- *used more problem-relevant knowledge in their problem solving.**

Processes for understanding as well as solving: Values and Mood

Values. A value is an enduring belief about the desirability of some means or action. Once internalized, a value also becomes a standard for guiding one's actions and thoughts, for influencing the actions and thoughts of others and for morally judging oneself and others.[1] Conceptualized in this way, values have a pervasive role in problem solving. They shape one's view of the current and desired goal state and figure centrally in the choice of actions to reduce the perceived gap.

To explain how values play such a role, it is necessary to situate them within two structures in the mind. One structure acts as a repository of one's goals and aspirations, as well as at least some of one's values. The purpose of this structure is to evaluate perceived information from the senses, deciding which to ignore and which to process further because of its potential

relevance to one's goals, aspirations and values. Such a structure is sometimes referred to as the "executive"; in Anderson's (1983) Act* theory, the function is performed by a "working memory". Situating values in an executive or working memory structure helps explain the pervasive but indirect effects that executives' values have on their actions; they provide perceptual screens which, as Hambrick and Brandon (1988) explain, allow the executive to "see what he wants to see" and "hear what he wants to hear".

Values also seem likely to exist, in two forms, in long term memory. In one form, they are embedded as integral parts of executives' organized knowledge structures (schema) about their organizational worlds, including procedures for how to solve known problems in that world. This is their implicit form. While values in this form are an important part of executives' domain-specific knowledge, executives often may not be consciously aware of such values and the strength of influence of their implicit values on their actions. Values also may be stored as independent structures in the mind - their explicit form. Executives are likely to be consciously aware of their values in this form and, hence, have more control over the influence of such values. Whether in their implicit or explicit forms, values stored in long term memory have direct effects on executives' *thoughts* about what actions to take - a "behavior channelling" effect (Hambrick & Brandon, 1988). Nevertheless, even when values are in explicit form, their effects on an executive's actions are mediated by the amount of discretion he or she possesses. Executives' actions are formed from thoughts about many matters in addition to their explicit values. But it is difficult for executives to escape from the influence of their implicit values and the values which act as perceptual screens.

Our own research with educational administrators (Begley & Leithwood, 1989; Campbell-Evans, 1988; Leithwood & Steinbach, 1991a) suggests that experts in comparison with non-experts:

- *are more aware of their values;*

- *use their values more regularly in solving ill-structured problems;*
- *use values as substitutes for knowledge in solving ill-structured problems.*

This research has also resulted in a classification of values used by educational administrators. Incorporating elements of Hodgkinson (1978), Beck (1984) and Hambrick and Brandon (1988), these value categories are identified later in the paper, and described in detail in Leithwood, Begley and Cousins (in press).

Mood. Knowledge is stored in the mind in several forms: words and pictures, for example. Furthermore, what is meant by "knowledge" goes considerably beyond the purely cognitive content implied by the term. In addition to values, as discussed above, other affective states or feelings also are a part of knowledge structures. An executive not only has stored in mind a procedure for facilitating the decision making of trustees, she or he also has associated (and therefore unavoidable) feelings about carrying out the procedure - despair, elation, fear, boredom and the like. Both the nature and strength of these feelings shape the mood experienced by the executive during problem solving. Additional feelings, for example, pressure and uncertainty coming from the context in which problem solving occurs, also contribute to the executive's mood. Research on social cognition suggests that, along with personal goals and the knowledge one possesses, mood has an important influence on the degree of cognitive flexibility one is able to exercise during problem solving. Showers and Cantor (1985) explain flexibility as:

> (a) adjusting interpretations in response to situational features; (b) taking control of [one's] thoughts and plans; (c) seeing multiple alternatives for interpreting the same event or outcome; and (d) changing [one's] own knowledge repertoire by adding new experiences and by reworking cherished beliefs, values, and goals. (p. 277)

Intense moods reduce such flexibility, thereby limiting problem solving effectiveness. Consistent with this explanation, our

research with principals (Stager & Leithwood, 1989, Leithwood & Steinbach, in press) has demonstrated that, in contrast with non-experts, experts:

- *are better able to control intense moods and remain calm during problem solving;*
- *are more self-confident about their ability to solve ill-structured problems;**
- *demonstrate consistent and genuine respect and courtesy toward staff during meetings and in subsequent reflections about those meetings;**
- *are more likely to be reflective about their behavior, thoughts and moods.**

This multi-component model of executive problem solving guided the collection and initial analysis of data in the study.

Method

Data for the study were collected through stimulated recall interviews (described below) conducted with seven "reputationally effective" superintendents. A letter was sent to every chief education officer in Ontario (called Directors, but referred to in this paper by the more common designation of superintendent) requesting them to nominate five superintendents who they believed had reputations with their peers as being particularly effective on the job. They were advised to use whatever criteria they considered relevant. One hundred and eleven ballots were sent out and 74 were returned. The eleven top ranking nominees were then invited to participate in the research. Ten of those eleven agreed. Of the ten, three subsequently dropped out for a variety of reasons (health, time, change of heart) resulting in a sample size of seven.

Data Collection.

Participants were asked to audio tape a portion of a regular meeting with their senior administrative colleagues, usually six to eight people, which would be dealing with a problem the superintendent expected to be particularly controversial or "swampy". They were asked to select a non-routine or complex problem because expert practitioners tend to deal with routine problems in a somewhat automatic fashion which makes it difficult to discern their thought processes (Leithwood & Stager, 1989).

Following the meeting, the superintendents were interviewed. Using the tape of the meeting to stimulate recall, superintendents were asked to comment on what they were thinking at various points. Both the superintendent and the interviewer stopped the tape frequently to ask questions or to offer information about intentions and thought processes. This discussion, recorded on a separate, subsequently transcribed tape, provided data for the study along with the record of the original meeting.

Stimulated recall methods used for data collection in this study seem likely to generate more valid data about superintendents' problem solving than other available methods. This conclusion is warranted as a consequence of the considerable debate about the validity of verbal reports as evidence of cognitive processes (e.g., Nisbett & Wilson, 1977; Ericsson & Simon, 1984). Based on a simple model of information processing, Ericsson and Simon (1984), for example, hypothesize that recently acquired (or needed) information is kept in short-term memory and, hence, is directly accessible for producing verbal reports. Information stored in long-term memory, however, must be retrieved before it can be reported; the retrieval process can threaten the validity of verbal reports because it can be incomplete and subject to many different types of distortion by the retriever. In the case of some research methods (e.g., retrospective interviews), questions are asked that cannot be answered without retrieving contents of long-term memory or that demand inferences on the part of the respondent rather than retrieval. Stimulated recall methods avoid relying on contents of long-term memory and compensate for

limitations on short-term memory. They do this through the play-back record of interaction that took place during problem solving and, when possible, through the collection of data immediately after that interaction. The method does not prevent respondents from relying on inferences, however.

Data Analysis.

Eighteen elements of expertise, identified with an asterisk in the Framework section of this paper, served as a focus for coding interview data collected from the superintendents. These elements emphasize the Solution Processes component within our model because of expectations created by our prior research about the more critical aspects of group problem solving.

For this study, each transcript was divided into relevant statements made by the superintendent. Two researchers (neither of whom was the interviewer to maintain objectivity) worked together to code the interviews according to the 18 elements. Researchers initially coded each protocol independently and then resolved all discrepancies in coding through discussion.

Results and Discussion

The study addressed two questions: What purposes are being served by superintendents' group problem solving? How do they achieve those purposes? Following a quantitative summary of the data, results are reported using the components of our framework as organizers. Where possible, similarities and differences with the results of other research are noted.

Quantitative Summary

Table 1 reports the number of statements found in the verbal protocols of superintendents which were coded according to each of the 18 elements selected from the problem-solving model: statements reflecting superintendents' values are reported separately (Table 3).

A superintendent's response, with respect to each element, potentially might vary widely in its level of expertise. However, the seven superintendents included in the study were selected because they had reputations among their peers in the province for being effective; confidence in the validity of our selection procedure was enhanced by the uniformly expert-like thinking exhibited by the superintendents judged in comparison with the results of our previous research. With the exception of one element, addressed later, the superintendents displayed expert-like processes in relation to each element of the problem solving model (Table 1 does not speak to this).

Insert Table 1 here

Given such uniformly expert processes, evidence in Table 1 clarifies which elements of problem solving received most and least attention (number of statements made) by superintendents in their thinking-aloud about their conduct of the meetings with their senior staffs, and in actual statements made during the meeting.

More than half the responses (58%) are accounted for by just six of the 18 problem-solving elements. The frequent occurrence of those six elements indicate that, in their meetings, superintendents:

- attended closely to and thought carefully about the implications of what was happening during the meetings. The meetings were very important to these superintendents and they worked hard at learning as much as possible from them (item 5.3; rank 1).
- assisted collaborative problem solving by summarizing, synthesizing, and clarifying as needed (item 4.6; rank 2).
- showed consistent and genuine respect for staff, both during and after the meeting (item 5.2; rank 3).
- interpreted the immediate problem in relation to the larger mission and problems of the board (item 1.1; rank 4).
- planned for and anticipated obstacles and responded flexibly to unanticipated obstacles (item 3.1; rank 4)
- clearly indicated their own point of view without intimidating or restraining others (item 4.4; rank 4).

Table 2 provides examples of the kinds of statements superintendents made for each of these six most frequently occurring items.

Insert Table 2 here

Processes Designed Primarily for Understanding Problems: Interpretation and Goals

Interpretation. The single element coded as Interpretation (1.1), "immediate problem viewed in a broader context" accounted for 7 percent of all coded statements, and was fourth ranked in frequency, as Table 1 indicates. The significance of this result can be understood better by comparing it with results of the coding of Solution Process items. A disproportionate number of such items were coded in the analysis because we believed this might constitute the focus of attention for the superintendents with their groups. This belief appeared to be unwarranted from the frequency counts alone, however. Two of the ten possible Solution Process items were ranked in the top six most frequently mentioned. But the remaining eight together accounted for only 31 percent of overall responses.

The fourth ranking of the one Interpretation element which was coded and the number of statements coded as self-reflection that concerned interpretations of the problem suggest consistency with previous evidence. This evidence describes experts solving problems individually devoting considerably greater attention than non-experts to problem interpretation, thereby reducing the demands placed on solution processes. Non-experts attempt to compensate, in vain, for inadequate attention to problem interpretation, by devoting substantially more effort to solution processes (Glaser & Chi, 1988; Reynolds, 1992; Leithwood & Steinbach, 1992).

There are, however, several other plausible explanations of these results. The groups may have been tolerant of vague or incomplete solution processes. The groups may have had such widely-shared understandings that their explicit talk carried richer and more elaborate meanings than the researchers understood; these understandings, furthermore, could have included

taken-for-granted delegations of responsibility to individuals for the further specification of general solutions suggested by the group.[2]

Goals. As Table 1 indicates, statements classified in terms of the three elements concerning goals accounted for a total of 12 percent of all coded statements. The majority of these statements (6 percent), coded as part of element 2.2, concerned the nature of the goals, themselves. Based on a previous study of expert principals solving problems in staff meetings (Leithwood & Steinbach, 1991b), we anticipated that superintendents would be attempting to find better solutions to their problems than would be likely were individual staff members to solve the problems by themselves. Instead, superintendents in this study usually brought to their meetings a well-worked out solution to the problem on the agenda. As one explained:

> "I'm very pleased because it's going exactly where I wanted it to go and it's coming from them. I'm not telling them what we're going to do; they are telling me what I'm going to do, but they are telling me what I want to hear."

Like typical principals in our previous study (but unlike our expert principals), superintendents had a preconceived solution in mind and the few statements coded as 2.1 reflected flexibility around how the solution would be played out. So what was the purpose of the meeting? Was it only to serve the goal, usually shunned by experts, of manipulating the group into agreeing on a pre-determined solution so that members of the group would be motivated to implement it?

Detailed analysis of statements coded under 2.2 suggested that superintendents were attempting to accomplish two types of goals. Their immediate goal was to "transform ideas into organizational reality" (Daniels, 1990, p. iii; their long term goal was organizational learning (e.g., Senge, 1990).

The problems the superintendents were solving with their colleagues in our study were primarily operational or maintenance problems (vs. strategic problems) and the context for solving

these problems was usually a regularly scheduled meeting. Daniels (1990) claims that "... what effective [executives] are doing in regular meetings is exercising the organization's formal power." (p. iii). Such meetings, according to Daniels, are not intended for solving problems. They are a step beyond that: their purpose is to ensure that those responsible for putting solutions into practice understand and agree with the solution: This is "... the step by which the organization's intelligence gets integrated into its operations." (Daniels, 1990, p. iii). From this perspective, it was not so much that the seven superintendents were not solving problems but that the nature of the problems they were solving had shifted. In these regular meetings which served as the context for this study, the primary problem was how to ensure that everyone responsible for implementing the solution knew, in general, what was to be done and, in particular, what that meant for the superintendents' practices. This is one meaning of transforming ideas into organizational reality.

The second type of goal the superintendents set for their regular meetings is encompassed in the meaning Senge (1990) attributes to organizational learning. Learning organizations, according to Senge, are:

> "... organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together." (p. 3)

Most superintendents made explicit statements about their long term purposes reflecting the aim of organizational learning. One said, for example:

> "We want to confirm leadership in the school and we want to clearly signal that things are under control, that problems are getting solved appropriately. We want to set the stage for addressing the longer term problems in the future, getting to the long term sorts of solutions."

Organizational learning depends on both individual and group learning, something the superintendents talked about in these terms, for example:

> "... my role is to make them as effective as possible. Therefore I feel that I have to do that in every respect, not only as they conduct their daily work, or entertain all their leadership assignments, but also as individuals."
>
> "My job is to facilitate that kind of process and then pick up what I can do to help that individual grow more effective ..."
>
> "... I think its my obligation and duty to sensitize the rest of staff in that regard [political reality]."
>
> "... if I can't read the group and work for them to keep contributing, then I shouldn't be in the role."

Processes Designed Primarily For Solving Problems: Constraints and Solution Processes

Constraints. The single element coded in relation to Constraints (3.1), "responds flexibly to unanticipated obstacles", encompassed 7 percent of all coded statements. Talk classified by this item, ranked fourth in frequency, was extensive and showed concern for flexibility among all superintendents.

Solution Processes. Table 1 indicates that statements coded in relation to the ten solution processes elements accounted for 50 percent of all coded statements. The three items (4.4, 4.6, 4.8) accounting for half of these statements suggest considerable thought by superintendents about how to maintain smoothly functioning group processes:

Item 4.4- Indicating own point of view but in a manner intended not to intimidate others or prevent them from offering their views.
Item 4.6- Summarizing, synthesizing and clarifying what is being said at appropriate times.
Item 4.8- Periodically checking on the levels of agreement, consensus and understanding developing among group members.

These superintendents took seriously the role of "leader", a role that Miles (1959) believed could be played by all members; he

argued that one of the main functions to be served by such a role was: "keeping the group maintained in working order" (p. 18), a task that includes "improving and maintaining working relationships" (pp. 19-20). Superintendents' attention to group interactions and concern for the group's development is evident from this remark:

> "I look upon it as an example of how the group has developed. Its much easier in relationship with one another and we're able to speak more authentically about what we're thinking and feeling. And actually the whole meeting was kind of a barometer about how the group was doing."

Statements coded as part of Solution Processes also described specific strategies used by superintendents to accomplish the two types of goals (described above) for these regular meetings. Four strategies were used in superintendents' efforts to transform ideas into organizational reality:

- *Deciding on the specific nature of the action to be taken*: Most superintendents used several strategies to help ensure complete agreement *around the solution*. Suggesting the value "Solidarity", it was important to them that everyone in the group "speak with the same voice" or carry the same message to the people with whom they worked. One way this happened was to ensure agreement on the details of the overall actions to be taken. For example:

  > "What I'm trying to do ... I need my team with me so that we're going in [to the meeting] with a common understanding of what the outcome is to be and how we're going to do it."

- *Being clear about the nature of the superintendents' actions for implementation*: another way of ensuring that everyone spoke with the same voice was to develop, with the group, those specific actions the superintendent would initiate to implement the solution. For example, one superintendent explained:

> "The point there was to engage them in planning how I would respond to the people who had initially brought the concern [Educational Assistants]. And that's how the rest of the meeting is cast. It's in terms of their helping me plan what I'm going to say when I go back to them. Writing a script for me."

- *Being clear about the nature of the actions to be carried out by other members of the group*: speaking with one voice was also fostered by explicitly working with the group on the actions other members of the group would take. For example:

> "Okay, as a summary then, you're going to do some editing. This will go to the next principals' meetings - both of them. The superintendents will follow up with one-on-one kind of interview with them and give them the support as we outlined in five."

- *Developing a viable implementation plan but remaining flexible in the face of alternative proposals offered by others*: as a kind of "fail-safe" mechanism, superintendents usually had thought through the implementation problem and identified, in their minds, a viable course of action. Such mental rehearsal seems likely to have prepared the superintendent for a role in the meeting of ensuring that the group does not fail to anticipate important obstacles and/or is unable to generate useful implementation steps. However, possibly reflecting their valuing of Participation, superintendents did not rigidly adhere to their own preconceived plans in the face of other good suggestions. For example:

> "I never have a clear idea what to expect exactly. I've got a general framework for what I anticipate happening in the meeting. But if the meeting is working well, there is a lot of spontaneous stuff going on. It's not like the thing is well planned out like a play or something like that. So there is lots of good discussion. But yes, overall, we accomplished what I hoped would be accomplished ..."

Previous evidence (Leithwood & Steinbach, 1991b) concerning the group problem solving of expert principals demonstrated efforts by

them to ensure that follow-up to group problem solving was planned, unlike their non-expert colleagues. The present study, however, suggests much greater attention by superintendents to this aspect of the problem, perhaps reflecting the more complex nature of the implementation problem at the district or system level, rather than the school level. As one superintendent said:

> "So in a meeting like this you need to send people away prepared to do business with the people they have to do business with ..."

Fostering organizational learning was the second type of goal these superintendents pursued in their regular meetings. This goal was defined largely by the learning of the immediate group of people involved in the meeting. To better understand the strategies or solution processes for fostering group learning used by the superintendents, we examined the data from a perspective provided by Senge (1990), who views group (or team) learning as "... the process of aligning and developing the capacity of a group to create the results its members truly desire." (p. 236). This happens when the group is able to think insightfully about complex issues by tapping the resources of many minds. There is also a need for innovative and coordinated action: Senge speaks of "'operational trust' ... each group member remains conscious of other group members and can be counted on to act in ways that complement each others' actions." (p. 236). Learning teams also foster other learning teams "... through inculcating the practices and skills of team learning more broadly." (p. 237).

There was evidence, in the verbal protocols, of superintendents attempting to meet Senge's three conditions for group learning. They tapped the mental resources of those in their groups by making sure everyone had an opportunity to participate. This was accomplished in several ways. For example:

- *Paying careful attention to body language:*
  "... reacting to your body language, your facial expression ... so that we can make sure that people

don't miss an opportunity to meaningfully communicate. I watch that fairly carefully."

- *Understanding and reacting to the particular needs of each individual.*

"[S] is sometimes intimidated by program and instructional intellect and I ... wanted to indicate to [him] that what he had to say was extremely valuable at that stage. If I allowed it to happen, he would wait until the end and that's becoming a pattern of his ..."

Examples of how superintendents encouraged innovative and coordinated action is provided by these comments:

"... the role I play frequently is making sure that we get all the data out on the table and listened to before we go ahead and make a decision."

"I see my role then as prodding, prompting, facilitating, encouraging ... causing people maybe to stretch themselves a little bit further than where they were ..."

Superintendents showed little evidence, however, of specifically fostering other learning teams. However, staff development was clearly an explicit goal of these superintendents. They said, for example:

"... my role is to make them as effective as possible. Therefore I feel that I have to do that in every respect, not only as they conduct their daily work, or entertain all their leadership assignments, but also as individuals."

"My job is to facilitate that kind of process and then pick up what I can do to help that individual grow more effective ..."

In addition to dialogue, Senge claims that "discussion" is a condition for group learning - the presentation and defense of different views and a search for the best view to help solve the problem. The intent of discussion is not to win, not to have your view prevail. Rather it is to clarify the meaning and consequences of the available alternatives to assist the group in finding the best solution to its problem. The superintendents encouraged such discussion in several ways, as these statements illustrate:

"If I can't read the group and work for them to keep contributing, then I shouldn't be in the role."

"One of my theories of a meeting is that you have to let the talk go on long enough to get everything that wants discussing out on the table. You make everything discussable by allowing somebody to introduce it."

Processes for Understanding As Well As Solving Problems: Values and Mood

Values. Table 3 reports the frequency of occurrence, in the protocols, of statements coded according to the four categories of specific values mentioned earlier: Basic Human Values, General Moral Values, Professional Values and Social and Political Values. Statements were coded as values when they had at least one of two characteristics: they included the explicit words or synonyms for words used to label the values in the values framework (e.g., "Participation by each member of the team is very important."); they identified an action or behavior clearly consistent with a value.

The latter coding method assumes a "behavior channelling" relationship between values and actions (Hambrick & Brandon, 1988). As a consequence, the role of values as "perceptual screens" is not reflected in our data. Values were ranked according to how frequently they were used. The three right hand columns provide comparable data on the ranking of values from our previous studies of expert principals (Leithwood & Steinbach, 1991b) and superintendents (Raun & Leithwood, in press; Leithwood & Steinbach, 1991a) using the same values framework.

Forty-two percent of all values statements were coded as Professional Values. Almost as many (40%) were coded as Basic Human Values. Relatively little use was made of either Social and Political Values (11%) or General Moral Values (5%). Such extensive reliance on Professional values and little reliance on General Moral Values is consistent with trends evident in the three previous studies, noted in Table 3. Discrepancies across studies are apparent, however, with respect to Basic Human Values and Social and Political Values. In both cases, the present study and Study Three share similar findings as do Studies One and Two.

While there may be several other explanations for these similarities and differences, it is noteworthy that both the present study and Study Three were carried out with "expert" administrators, although from different roles; Studies One and Two included samples selected without reference to expertise, but from the same role.

Table 3 also shows the ranking of specific values associated with each of the four categories for the present study, as well as the three previous studies. Role Responsibility and Respect for Others are among the most frequently identified values in the present study as well as two of the three remaining studies. Knowledge, ranked second in the present study, was also a prevalent value in Study One, although this is not evident in the data used for Table 3. Finally, Consequences (for immediate clients and/or the system at large) and Participation are additional specific values ranked relatively highly in the present, as well as several of the previous studies.

Raun and Leithwood (in press) concluded that pragmatism (Consequences), participation and duty (Role Responsibility) were prevalent value themes in their study of superintendents' values. The present study provides additional support for this claim.

Insert Table 3 here

Mood. Table 1 indicates that about a quarter of all verbal protocol statements coded concerned aspects of mood. Only three statements related to being calm and confident (item 5.1) were evident in the transcripts. However, this aspect of mood is better reflected in the tone of the superintendents' talk than in their explicit words. All of the superintendents demonstrated an "air" of self-confidence: several explicit statements reflect this, even in the face of surprising or damaging information:

> "Nobody makes a mistake except [me]."
>
> "I guess at this point I think it's important to reassure them we're not any more vulnerable than we

> think we are. Let's not travel down this pathological road to saying everything is falling apart ..."

The attitude displayed in these comments also seems likely to encourage risk-taking since the superintendents are taking ultimate responsibility for decisions made by the group.

Twelve percent of coded statements reflect genuine respect and courtesy on the part of superintendents toward their colleagues. For example:

> "That was a check to see if she was in a position to really participate extensively."

A slightly larger percentage of statements, the most frequent overall, demonstrate a self-reflective habit of mind on the part of these superintendents. This habit may explain how experts learn from experience or at least how these superintendents use these meetings to guide their own learning. Self-reflection was evident in such comments as:

> "So while he was saying 'here's the problem as I see it', I've identified another problem that I want to raise with him in terms of how we get secondary school programs written, rewritten, refined, and perhaps it's time to reconceptualize."

Summary and Conclusion

The social, political and economic upheavals witnessed throughout the developed world in the last half dozen years have threatened the very survival of organizations previously considered invincible: Eastern European political structures, General Motors and the Roman Catholic church are cases in point. And so are North American public schools. Widespread calls for restructuring, growth in private school attendance, greater choice, and taxpayer discontent with education expenditures are among the more visible indications that this is so. One consequence of this turbulent environment for school superintendents, as for CEOs in many other types of organizations,

is a significant erosion in the predictability of the problems they face, and increased demands on their capacities to respond expertly to a much higher proportion of ill-structured problems. In addition, the preferred structural response to this turbulent environment in school systems, as in many other types of complex organizations (Naisbett & Aburdene, 1987; Toffler, 1990) is debureaucratization. For superintendents, this is coming to mean various forms of school-based management and shared decision making. Not only are superintendents faced with a much higher proportion of ill-structured problems, but the forum for solving those problems is increasingly the group or team.

While expertise in group problem solving thus appears critical to current and future superintendents, there is almost no formal knowledge about it. Providing some of that knowledge was the stimulus for this study. The study inquired, in particular, about the goals to be accomplished and the processes used by superintendents in solving problems during regular meetings with their senior staffs. Results of prior, information-processing-oriented, studies were used to provide a framework for collecting and analyzing verbal protocols collected, using stimulated recall techniques, with seven reputationally effective superintendents. This framework highlighted, as important elements of problem solving, processes used by superintendents primarily to understand their problems (interpreting problems and setting goals), and to solve their problems (responding to constraints and generating solution processes). Also examined were the roles, in both understanding and solving problems, of superintendents' values and affective states.

Several features of the study argue for caution in interpreting results: in particular, the small sample size, the "reputational" method of sample selection and the lack of a non-expert comparison group (overcoming these limitations in subsequent research would add considerably to the knowledge base). In spite of these reasons for caution, the results, in our view, provide a useful beginning for a much-needed program of research. The results suggest that superintendents use their group problem-solving

processes for two purposes. The short-term purpose, after Daniels' (1990), was to transform ideas into organizational reality. This meant ensuring that the solution to problems were systematically reflected in the subsequent practices of the superintendents' senior colleagues, as well as in their own practices. A second, longer term purpose was organizational learning, as conceptualized by Senge (1990).

Using prior research about principals' problem solving as a basis for comparison, the superintendents' problem-solving processes appeared to be highly expert. Superintendents helped their colleagues to place the immediate problem they were addressing in a broader context and to anticipate constraints. They also conducted the meetings so as to ensure the contribution of most in attendance. Furthermore, they were especially reflective about the meetings, both during the meetings and after the meetings were finished; they monitored progress in the meetings very closely but only intervened personally when the process began to stall or no one else was willing or able to further the groups' progress. The superintendents were explicit about their own efforts to learn as much as possible from the meeting.

One practical implication of this research concerns the urgency of further developing group problem-solving capacities among prospective and existing superintendents. These capacities seem likely to be an important part of the repertoire of those who would exercise transformational leadership (e.g., Burns, 1978; Bass, 1985; Leithwood, 1992; Sergiovanni, 1991). This is a form of leadership especially well suited to flatter organizations based, as it is, on collegial and expert sources of power exercised through the exchange of ideas within groups.

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Notes

1. Elements of the definition can be found in the work of Hodgkinson (1978), Rokeach (1975), Kluckhon (1951) and Williams (1968).
2. We are indebted to Peter Ross for pointing out these possibilities.
3. A survey of values carried out with 53 Ontario Chief Education Officers (Raun & Leithwood, in press).
4. Values evident in the individual problem solving of 8 Ontario Chief Education Officers (Leithwood & Steinbach, 1991a). These CEOs were selected without reference to their expertise.
5. Values evident in the group problem-solving processes of 4 expert elementary school principals (Leithwood & Steinbach, 1991b).

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Table 1:
Statements in protocols coded as different components of problem solving (values omitted)

Problem Solving Components	Total Frequency	Mean	Percent of Total	Rank
1. Interpretation				
1.1 Immediate problem viewed in broader context	32	4.6	7	4
2. Goals				
2.1 Less of a personal stake in preconceived solution	9	1.3	2	16
2.2 Broad range of goals	29	4.1	6	7
2.3 Staff development an explicit goal	16	2.3	4	12
3. Constraints				
3.1 Responds flexibly to unanticipated obstacles	32	4.6	7	4
4. Solution Processes				
4.1 Has well developed plan	14	2.0	3	13
4.2 Provides clear introduction	12	1.7	3	14
4.3 Outlines the process for problem solving	7	1.0	2	17
4.4 Indicates own point of view without intimidating others	32	4.6	7	4
4.5 Remains open to new information	12	1.7	3	15
4.6 Summarizes, synthesizes, clarifies etc.	56	8.0	12	2
4.7 Balances need to keep group focused and need for open discussion	21	3.0	5	10
4.8 Checks for consensus, agreement, understanding	27	3.9	6	8
4.9 Ensures that follow-up is planned	19	2.7	4	11
4.10 Use of problem-relevant knowledge	22	3.1	5	9
5. Affect/Mood				
5.1 Always appears calm and confident	3	0.4	.01	18
5.2 Genuine respect and courtesy shown to staff	54	7.7	12	3
5.3 Self-reflection	58	8.3	13	1

Table 2
Examples of protocol statements coded in relation to the most frequently occurring items

Rank	Components	Examples
1.	*5.3 - Self-reflection*	"And I'm asking myself, while I hear that, whether our current organization and structure is adequate."
		"What goes on in my head is, wow, conceptually we've got a difficulty here which won't affect the memo but is something I have to store for future reference."
2.	*4.6 - Summarizes, synthesizes, clarifies, etc.*	"Your words reflect the need for some in-service, even for them."
3.	*5.2 - Genuine respect and courtesy shown to staff*	"I really appreciate all the back-up. It really helps me."
		"I cheer him on. This is the superintendent of program. This chap has come a long way."
4.	*1.1 - Immediate problem viewed in broader context*	"And that's what was going through my mind. Here was an opportunity to again reference that second strategic direction. I point to an area [school based decision making] where we can start to move."
		"We have as part of our philosophy 'people before things', involvement in decision making, and yet here we are still solving the problem."
4.	*3.1 - Responds flexibly to unanticipated obstacles*	"There may be some awkward silences as we sort of look around and [think] what do you want us to say today? But really we have to be able to make a move somehow."
		"Now there's conflict between S and S and they will go after each other. His question is unclear and sounds like he's setting him up. So I now start to focus on whether there's a set-up and whether I need to do anything."
4.	*4.4 - Indicates own point of view without intimidating others*	"One of the real underlying issues is who decides what the responsibility of the [Educational Assistant] should be. And they seem to be saying overtime is better than lieu time because [then] we know that we are needed. And that seems to be a question of, you know, who defines when and where they're needed. Is it the teacher, the principal, or them? I think the principal. Am I making sense in that analysis?"

Table 3:

Statements in protocols coded as different types of values: Current vs. previous studies

Categories of Values	# CEOs (N=7)	Present Study Frequency	%	Rank	Rank in Previous Studies Study 4[3]	Study 5[4]	Study 6[5]
1. Basic Human Values							
TOTAL	7	189	40	(2)	(4)	(4)	(2)
1.1 Freedom					14	7	11
1.2 Happiness					11	13	
1.3 Knowledge	7	95	20	2	10	6	5
1.4 Respect for Others	7	94	20	2	1	7	2
1.5 Survival					17	13	
2. General Moral Values							
TOTAL	5	23	5	(4)	(3)	(3)	(4)
2.1 Carefulness	4	13	3	6	5	9	9
2.2 Fairness	5	10	2	7	3	2	9
2.3 Courage					18	13	
2.4 Honesty					9		
3. Professional Values							
TOTAL	7	193	42	(1)	(2)	(1)	(1)
3.1 Gen. Resp.: Educator	1	1	1	9	7	9	6
3.2 Role Resp.	7	127	27	1	16	1	1
3.3 Consequences: Imm. Clients					7	3	4
3.4 Consequences: Others (system)	7	65	14	4	3	13	
4. Social & Political Values							
TOTAL	7	49	11	(3)	(1)	(2)	(3)
4.1 Participation	7	33	7	5	13	3	3
4.2 Sharing	2	4	1	9	12	9	6
4.3 Loyalty, Solidarity, Commitment	5	11	2	7	2	3	8
4.4 Helping others	1	1	1	9	5	7	